We claim :

1. A method for estimating an optimal dosage of bleaching agent to be used in a process for producing pulp of a required brightness value from wood chips, said method comprising the step of:

i) estimating a set of wood chip properties characterizing said wood chips to generate corresponding wood chip properties data, said set including reflectance-related properties;

said method being characterized by further comprising the steps of:

ii) providing an initial dosage value of said bleaching agent; and

iii) feeding said wood chip properties data and said bleaching agent dosage value at corresponding inputs of a predictive model (10) for generating predicted brightness value of pulp to produce from said wood chips, to estimate the optimal bleaching agent dosage for which said predicted brightness value substantially reaches said required brightness value.

2. The method according to claim 1, wherein said set of wood chips properties further includes wood chip size.

3. The method according to claim 1, wherein said set of wood chips properties further includes moisture.

4. The method according to claim 1, wherein said predictive model estimate the optimal bleaching agent dosage by performing the steps of:

a) comparing said brightness predicted value with said required brightness value to generate error data;

b) optimizing said bleaching agent dosage value to minimize said error data; and

c) repeatedly generating predicted brightness value and performing said steps a) and b) with the optimized bleaching agent dosage value until said predicted brightness value substantially reaches said required brightness value, to estimate said optimal bleaching agent dosage.

5. The method according to claim 1, wherein said predictive model includes a neural network (12) previously trained according to experimentally obtained data on said wood chip properties and on dosage of said bleaching agent.

6. A method of controlling the bleaching of pulp in a pulp production process on the basis of the optimal bleaching agent dosage estimated according to the method of claim 1, said pulp production process including, between said steps i) and iii), at least one processing step including a step of refining said wood chips to produce refined wood chips, said control method comprising the step of:

a) adding bleaching agent to said refined wood chips according to said optimal bleaching agent dosage to produce said pulp.

7. The method according to claim 6, wherein said pulp production process is continuous, said set of wood chip properties data are filtered according to an attenuation of said estimated wood chip properties caused by said at least one processing step.

8. The method of claim 6, further comprising the step of :

b) repeating said step i) to generate wood chip properties data corresponding to a new estimation of the set of wood chip properties characterizing said wood chips;

c) repeating said step iii) with said optimal bleaching dosage to provide a new estimation of the optimal bleaching dosage; and

d) adding bleaching agent to said refined wood chips according to said new estimation of bleaching agent dosage to produce said pulp.

9. A method of controlling the bleaching of pulp in a pulp production process on the basis of the optimal bleaching agent dosage estimated according to the method of claim 1, said pulp production process including, between said steps i) and iii), at least one processing steps including a step of refining said wood chips to produce refined wood chips, said control method comprising the step of:

a) estimating a resulting brightness value of the pulp according to a time delay following said predicted brightness value generation;

b) comparing said predicted brightness value with said resulting brightness value to generate further error data;

c) further optimizing said bleaching agent dosage value to minimize said further error data; and

d) adding bleaching agent to said refined wood chips according to said further optimized bleaching agent dosage to produce said pulp.

10. An apparatus for estimating an optimal dosage of bleaching agent to be used in a process for producing pulp of a required brightness value from wood chips, said apparatus comprising:

means (14) for estimating a set of wood chip properties characterizing said wood chips to generate corresponding wood chip properties data, said set including reflectance-related properties;

said apparatus being characterized by further comprising:

data processor means implementing a predictive model (10) receiving at corresponding inputs thereof said wood chip properties data and an initial bleaching agent dosage value for generating predicted brightness value of pulp to produce from said wood chips, to estimate the optimal bleaching agent dosage for which said predicted brightness value substantially reaches said required brightness value.

11. The apparatus according to claim 10, wherein said predictive model (10) includes:

a) means (24) for comparing said brightness predicted value with said required brightness value to generate error data; and

b) means (26) for optimizing said bleaching agent dosage value to minimize said error data.

12. The apparatus according to claim 10, wherein said predictive model (10) includes a neural network previously trained according to experimentally obtained data on said wood chip properties and on dosage of said bleaching agent.

13. A system of controlling the bleaching of pulp in a pulp production process on the basis of the optimal bleaching agent dosage estimated by the apparatus according to claim 10, said pulp production process including at least one processing steps including a step of refining said wood chips to produce refined wood chips, said control system comprising means (16) for adding bleaching agent to said refined wood chips according to said optimal bleaching agent dosage to produce said pulp.

14. A system for controlling the bleaching of pulp in a pulp production process on the basis of the optimal bleaching agent dosage estimated by the apparatus according to claim 10, said pulp production process including at least one processing

steps including a step of refining said wood chips to produce refined wood chips, said control system comprising:

means for estimating a resulting brightness value of the pulp according to a time delay following said predicted brightness value generation by said predictive model (10);

means for time delaying said predicted brightness value according to said time delay;

means (38) for comparing said delayed predicted brightness value with said resulting brightness value to generate further error data;

said predictive model (10) further optimizing said bleaching agent dosage value to minimize said further error data; and

means (16) for adding bleaching agent to said refined wood chips according to said further optimized bleaching agent dosage to produce said pulp.

15. The system according to claim 14, wherein said pulp production process is continuous, said system further comprising means for filtering said set of wood chip properties data according to an attenuation of said estimated wood chip properties caused by said at least one processing step.

AMENDED CLAIMS
[received by the International Bureau on 22 April 2005 (22.04.05);
original claims 1-15 replaced by amended claims 1-13(4 pages)]

1. A method for estimating an optimal dosage of bleaching agent to be used in a process for producing pulp of a required brightness value from wood chips, said method comprising the step of:

i) estimating a set of wood chip properties characterizing said wood chips to generate corresponding wood chip properties data, said set including reflectance-related properties;

said method being characterized by further comprising the steps of:

ii) providing an initial dosage value of said bleaching agent; and

iii) feeding said wood chip properties data and said bleaching agent dosage value at corresponding inputs of a predictive model (10) for generating predicted brightness value of pulp to produce from said wood chips, to estimate the optimal bleaching agent dosage for which said predicted brightness value substantially reaches said required brightness value, wherein said predictive model estimate the optimal bleaching agent dosage by performing the steps of:

a) comparing said brightness predicted value with said required brightness value to generate error data;

b) optimizing said bleaching agent dosage value to minimize said error data; and

c) repeatedly generating predicted brightness value and performing said steps a) and b) with the optimized bleaching agent dosage value until said predicted brightness value substantially reaches said required brightness value, to estimate said optimal bleaching agent dosage.

2. The method according to claim 1, wherein said set of wood chips properties further includes wood chip size.

3. The method according to claim 1, wherein said set of wood chips properties further includes moisture.

4. The method according to claim 1, wherein said predictive model includes a neural network (12) previously trained according to experimentally obtained data on said wood chip properties and on dosage of said bleaching agent.

5. A method of controlling the bleaching of pulp in a pulp production process on the basis of the optimal bleaching agent dosage estimated according to the method of claim 1, said pulp production process including, between said steps i) and iii), at least one processing step including a step of refining said wood chips to produce refined wood chips, said control method comprising the step of:

d) adding bleaching agent to said refined wood chips according to said optimal bleaching agent dosage to produce said pulp.

6. The method according to claim 5, wherein said pulp production process is continuous, said set of wood chip properties data are filtered according to an attenuation of said estimated wood chip properties caused by a time delay induced by said at least one processing step.

7. The method of claim 5, further comprising the step of :

e) repeating said step i) to generate wood chip properties data corresponding to a new estimation of the set of wood chip properties characterizing said wood chips;

f) repeating said step iii) with said optimal bleaching dosage to provide a new estimation of the optimal bleaching dosage; and

g) adding bleaching agent to said refined wood chips according to said new estimation of bleaching agent dosage to produce said pulp.

8. A method of controlling the bleaching of pulp in a pulp production process on the basis of the optimal bleaching agent dosage estimated according to the method of claim 1, said pulp production process including, between said steps i) and iii), at least one processing steps including a step of refining said wood chips to produce refined wood chips, said control method comprising the step of:

d) estimating a resulting brightness value of the pulp according to a time delay following said predicted brightness value generation;

e) comparing said predicted brightness value with said resulting brightness value to generate further error data;

f) further optimizing said bleaching agent dosage value to minimize said further error data; and

g) adding bleaching agent to said refined wood chips according to said further optimized bleaching agent dosage to produce said pulp.

9. An apparatus for estimating an optimal dosage of bleaching agent to be used in a process for producing pulp of a required brightness value from wood chips, said apparatus comprising:

means (14) for estimating a set of wood chip properties characterizing said wood chips to generate corresponding wood chip properties data, said set including reflectance-related properties;

said apparatus being characterized by further comprising:

data processor means implementing a predictive model (10) receiving at corresponding inputs thereof said wood chip properties data and an initial bleaching agent dosage value for generating predicted brightness value of pulp to produce from said wood chips, to estimate the optimal bleaching agent dosage for which said predicted brightness value substantially reaches said required brightness value, wherein said predictive model (10) includes:

means (24) for comparing said brightness predicted value with said required brightness value to generate error data; and

means (26) for optimizing said bleaching agent dosage value to minimize said error data.

10. The apparatus according to claim 9, wherein said predictive model (10) includes a neural network previously trained according to experimentally obtained data on said wood chip properties and on dosage of said bleaching agent.

11. A system of controlling the bleaching of pulp in a pulp production process on the basis of the optimal bleaching agent dosage estimated by the apparatus according to claim 9, said pulp production process including at least one processing steps including a step of refining said wood chips to produce refined wood chips, said control system comprising means (16) for adding bleaching agent to said refined wood chips according to said optimal bleaching agent dosage to produce said pulp.

12. A system for controlling the bleaching of pulp in a pulp production process on the basis of the optimal bleaching agent dosage estimated by the apparatus according to claim 9, said pulp production process including at least one processing steps including a step of refining said wood chips to produce refined wood chips, said control system comprising:

means for estimating a resulting brightness value of the pulp according to a time delay following said predicted brightness value generation by said predictive model (10);

means for time delaying said predicted brightness value according to said time delay;

means (38) for comparing said delayed predicted brightness value with said resulting brightness value to generate further error data;

said predictive model (10) further optimizing said bleaching agent dosage value to minimize said further error data; and

means (16) for adding bleaching agent to said refined wood chips according to said further optimized bleaching agent dosage to produce said pulp.

13. The system according to claim 12, wherein said pulp production process is continuous, said system further comprising means for filtering said set of wood chip properties data according to an attenuation of said estimated wood chip properties caused by a time delay induced by said at least one processing step.